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**USER COSTS  
IN ROAD TRAFFIC**

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**1988**

by  
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### Notes to the Foreign Reader

This report is a translation of the original Finnish publication "*Tieliikenteen ajokustannukset 1988*", published annually by the Research Office of RWA's Economic Division. English edition by Nils Halla and Arto Tevajarvi.

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The currency in the cost tables is Finnish Mark (FIM) and metric units are used throughout.

Some exchange rates (April 6, 1988): 1 FIM = 100 penniä (p)

1 USD	=	4,10 FIM
1 GBP	=	7,70
1 SEK	=	0,69
1 NOK	=	0,65
1 DKK	=	0,64
1 DEM	=	2,46
1 FRF	=	0,73

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## To the Reader

The Research Office of the Roads and Waterways Administration (RWA) has ever since 1978 been responsible of publishing this annual report on the road user costs. Figures and values in this report are outlined according to the roadkeepers point of view of purchase and operating costs of vehicles. These values are meant to be used in economic evaluations of public road projects.

Road user costs consist of three cost factors: *vehicle, time and accident costs*. They also describe wider the consequences which affect the use of vehicles. *Vehicle costs* can be linked with such expressions as mobility, use of money and driving comfort. *Time costs* respectively are connected to easier accessibility and driving comfort. *Accident costs* are linked with traffic safety.

The vehicle cost values are presented as prime cost prices including indirect taxes. The percentage of indirect taxes are presented, so the calculations can be made without taxes if needed. As a rule it is recommended to use values which include indirect taxes. In the tables can also be found the amount of capital cost in vehicle costs.

The principles of the evaluation of user costs are being developed for years. So it is inevitable that some values are only limitedly comparable with values in the very early reports. However, since 1983 the principles have been almost the same.

*The most notable change in this report concerns the percentage of indirect taxes in vehicle costs. Especially this can be seen in vehicle costs of passenger cars and busses.*



## 1 SUMMARY OF THE ROAD USER COSTS IN 1988

The price level in tables is according to the January 1988. Principles of evaluating the unit value costs are found in paragraphs 3.1 - 3.3.

### A: Vehicle costs (annual average)

Vehicle	Vehicle-cost p/km	Amount of indirect taxes	
		p/km	%
Passenger car	107	36	33
Van	123	28	23
Bus	320 <sup>1</sup>	39	12
Truck	346	85	24

### B: Time costs

#### Passenger car

Purpose of trip	FIM/hour	
	/person	/vehicle <sup>2</sup>
Work	64,40	70,80
Business (work/personal)	14,40	21,50
Leisure and holiday	8,20	18,90
Combined value	(16,10)	28,75

#### Other cars

Vehicle	FIM/hour	
	/person	/vehicle <sup>2</sup>
Van	57,90	57,90
Truck	72,60	79,90
Bus (on public roads)		445,70

<sup>1</sup> Busowners operating in regular routes do not pay fuel taxes. The actual numbers are then 298, 29 and 10.

<sup>2</sup> Value of time of the average number of passengers (incl. the driver) in the vehicle.

C: Accident costs in public roads<sup>1</sup>

Type of injury/ Accident type	Cost (FIM)
Fatalities	3 250 000
Permanently injured	1 150 000
Temporarily injured	35 000
Injured in average	90 000
Fatal accident	3 700 000
Injurious accident	140 000
Injury accident (average)	575 000
Material damages only	20 000
Road accident in average	190 000

Tables on pages 12...17 contain also time and accident costs as p/km.

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<sup>1</sup> Values are based on RWA's accident statistics.

D. Road user costs in graphs

Fig. 1: Percent shares of factors in vehicle costs of passenger cars and trucks in average (speed: pass. car 90 km/h and truck: 80 km/h)

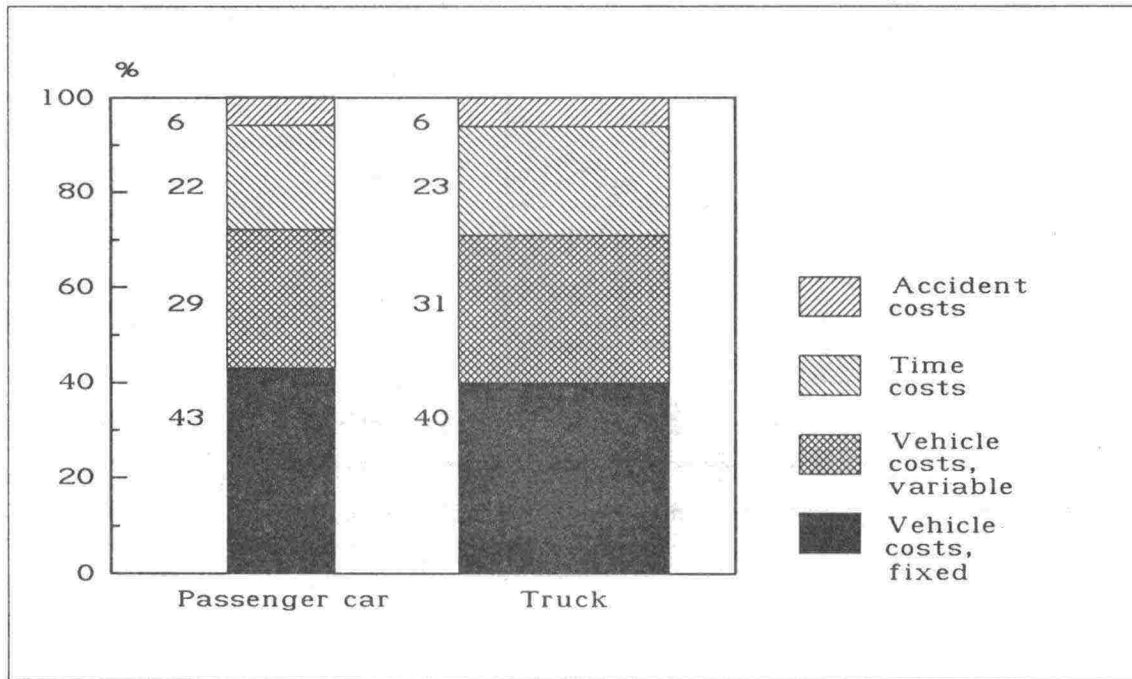


Fig. 2: Average formation of vehicle cost of various types of cars

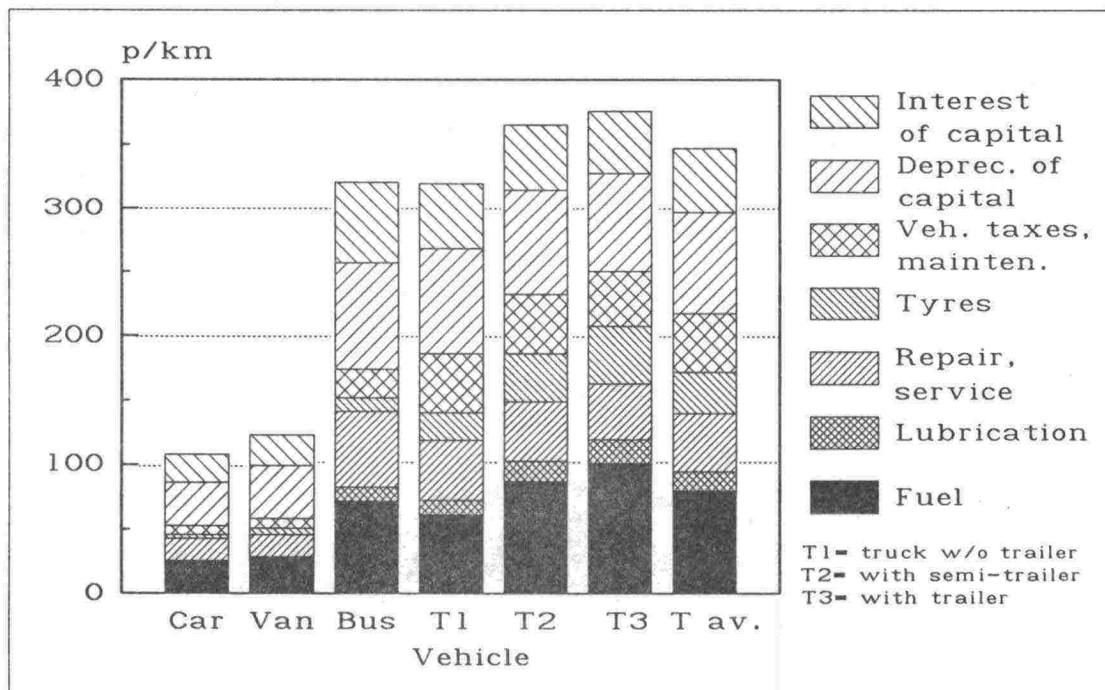


Fig. 3: Average vehicle costs of passenger car on various road classes and speeds

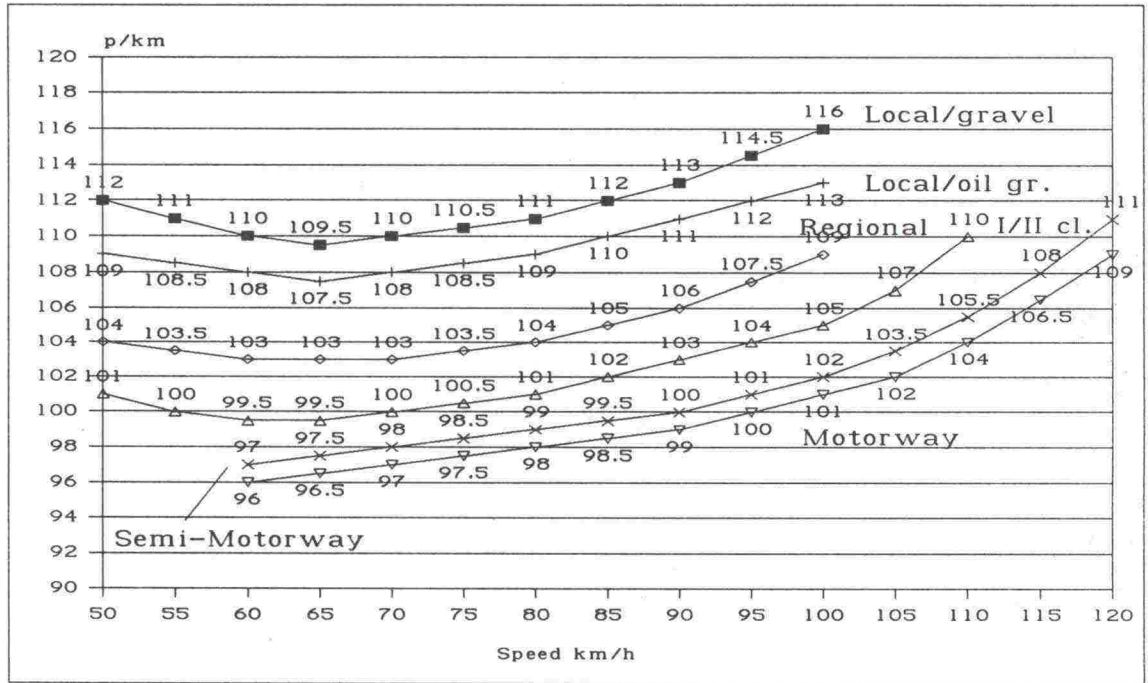


Fig. 4: Average vehicle costs of truck on various road classes and speeds

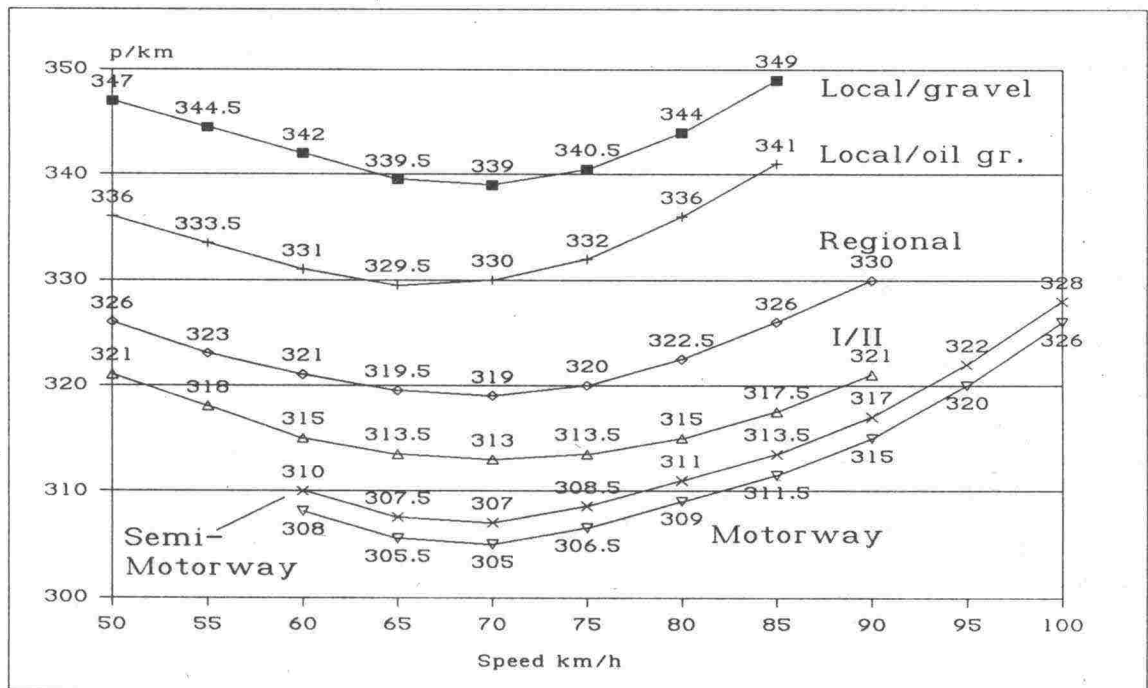
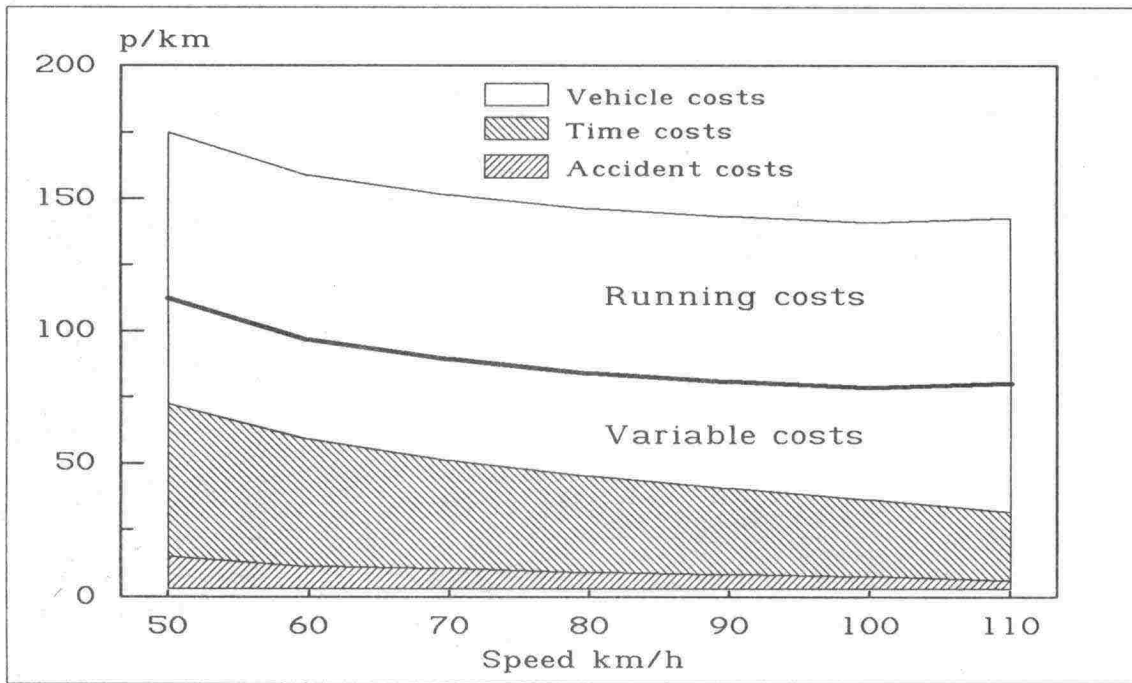
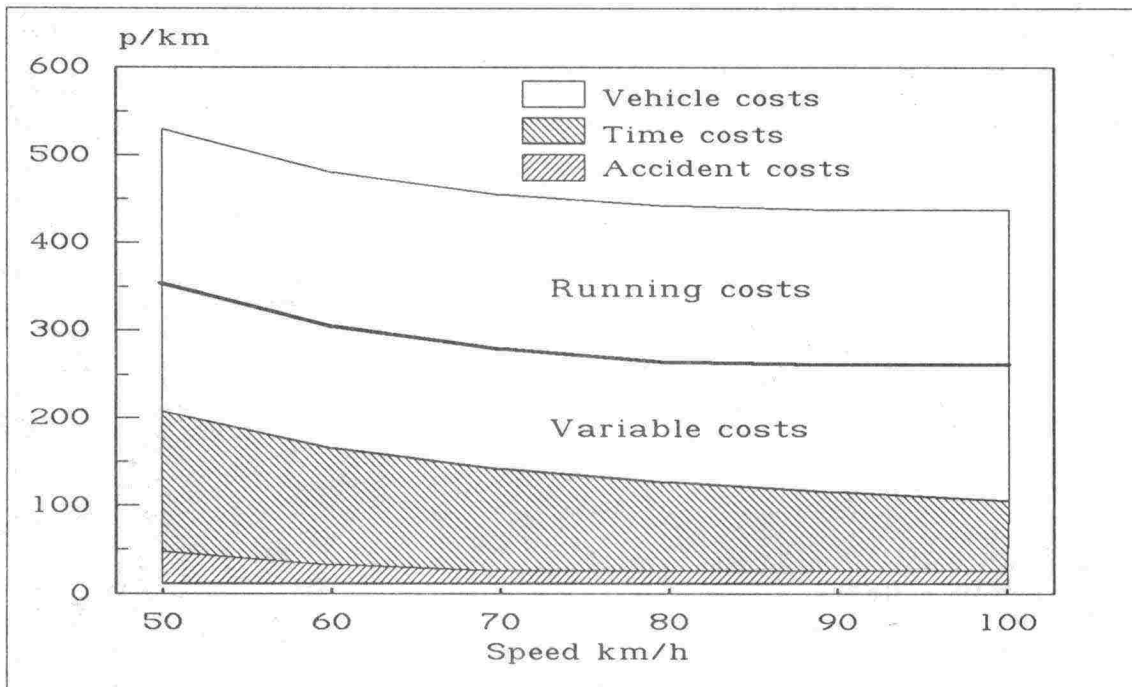




Fig. 5: Shares of cost factors in the user cost of passenger car, in various speeds on main roads



Kuva 6: Shares of cost factors in the user cost of truck, in various speeds on main roads



## 2 ROAD USER COSTS FOR THE YEAR 1988: TABLES

### NOTES TO THE USER

For the economic evaluation of road projects' alternatives there are in tables 1...6 and 9...11 given user costs of an average passenger car and truck at various speeds. In the economic evaluations the speed is the average speed of the vehicles (passenger car, truck) on road sections in question.

Vehicle and accident costs have been estimated for road classes (classified according to their functional meaning) to correspond to the present average traffic conditions on that road class in summertime when the speed is relatively steady. The table values of vehicle costs represent the average condition of a road class. The average values or basic values should be corrected by correction factors to correspond to the actual pavement conditions of a road. The correction factors are given in table form and they depend on the evenness of the road's surface. Usually it is recommended to use the basic values (average condition).

The effect of hilliness and traffic flow to the vehicle costs can be estimated using the change values given in tables 1 and 2 (change p/km, plus or minus).

*First must be done the possible correction due to the condition of the road surface and after that, if needed, corrections due to other than average road geometry and traffic volume.*

When evaluating alternative maintenance measures should the weather and road condition been taken into consideration. Correction factors for different weather and road conditions are in tables 13 and 14, but in normal evaluation of road projects they are not needed.

In tables 9...11 there are average user costs for urban area conditions. These values can be used when evaluating congested traffic on main road projects. When the speed is steady, vehicle costs in tables 1 and 2 are also valid for urban area evaluations.

Some judgement is needed when using cost values, because the average values as such seldom correspond to the reality on some certain road project.

Eg. due to a reconstruction project of a road the speed of vehicles as a rule increases and the characteristics of the road improve although the functional class of the road do not change. Changes in vehicle costs and accident rate/costs must then be estimated comparing different rows of the cost tables.

In economic evaluations can vans be treated as passenger cars and busses as trucks, if there is no special reason to handle them separately.

*If the lengths of the alternative road projects vary to a great extent, it is recommended to use vehicle costs for passenger cars without fixed costs.*

## EXAMPLES OF DEFINING VEHICLE COSTS

**Example 1** Regional road (asphalt concrete) will be reconstructed, the functional class does not change.

Actual average speeds (km/h):

- present road 1. year:	car 85, truck 81
- present road 10. year:	car 75, truck 75
- improved road:	whole evaluation period: car 90, truck 81

Vehicle costs for the present road should be taken from the row of regional road:

- present road 1. year:	car 105, truck 323 p/km
- present road 10. year:	103,5+2 and 321+5 p/km (extra cost due to increased traffic added)

The actual class of the improved road is Main II, so the vehicle costs must be taken respectively from the Main I/II row. Here the increased traffic has no effect on vehicle costs:

car 103, truck 315 p/km

**Example 2** Regional road, which is hilly, curved and with poor pavement will be improved. The vehicle costs of present road are the same as on poor local road with oil gravel pavement.

Actual speeds (km/h):

- present road:	car 78, truck 70
- improved road:	car 82, truck 78

Respective vehicle costs are:

- present road:	car 1,03x104	=107 p/km
	truck 1,03x322	=332 p/km
- improved road:	car	105 p/km
	truck	322 p/km

**Example 3** The vehicle costs in congested main roads should be taken for rush hours from table 9 and for the rest of the time from tables 1 and 2 (the possible extra cost due to above average traffic must be added).



## GENERAL INFORMATION

## ABBREVIATIONS OF ROAD TYPES

Motorway	=	Motorway (two lanes)
Semi-Mw	=	Semi-motorway (one lane)
Main I/II	=	Main roads, I and II class
Regional	=	Regional roads
Local/oil gr.	=	Collector/Connecting roads, oil gravel
Local gravel	=	Collector/Connecting roads, gravel

## ROAD AND TRAFFIC CONDITIONS

The cost values are calculated to correspond to the following average conditions on various types of roads (excl. the urban area tables):

Road	Pavement	Hilliness m/km	Curvature grad/km	Traffic volume <sup>1</sup>
Motorway	AB	-	-	17000
Semi-Mw	AB	-	-	6000
Main I/II	AB	10	20	2800
Regional	AB	15	50	1200
Local/oil gr.	ÖS	20	90	400
Local/gravel	SR	20	90	150

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<sup>1</sup> Average daily traffic (ADT)

## VEHICLE COSTS - Passenger car

Table 1: Vehicle costs of passenger car (p/km)

Passenger car	Speed km/h							
	50	60	70	80	90	100	110	120
Motorway	-	96	97	98	99	101	104	109
Semi-mw	-	97	98	99	100	102	106	110
Main I/II	101	99	100	101	103	105	110	
Regional	104	103	103	104	106	109		
Local/oil gr.	109	108	108	109	111	113		
Local/gravel	112	110	110	111	113	116		

Share of fixed costs is 62 p/km

See also pic. 3 (p. 7)

## Correction factors:

Condition of pavement:	Good	Average	Poor
Motorway, Semi-Mw, Main I/II, Regional	0,99	1,00	1,03
Local/oil gravel	0,99	1,00	1,03
Local/gravel	0,99	1,00	1,03

## Change p/km:

Hilliness:	0 m/km	Average	35 m/km
Motorway, Semi-Mw	-	-	-
Main I/II, Regional	-1	-	+2
Local	-1	-	+2

Traffic volume (ADT):	-100%	Average	+200%	+300%
Motorway	-	-	-	+1
Semi-Mw	-	-	+1	+2
Main I/II	-1	-	+1	+3
Regional	-2	-	+2	+3
Local	-2	-	+2	+4

## VEHICLE COSTS - Truck

Table 2: Vehicle costs of truck (p/km)

Truck	Speed km/h							
	50	60	70	80	90	100	110	120
Motorway	-	308	305	309	315	326		
Semi-mw	-	310	307	311	317	328		
Main I/II	321	315	313	315	321	332		
Regional	326	321	319	323	329			
Local oil gr.	336	331	330	336				
Local/gravel	347	342	339	344				

Share of fixed costs 175 p/km  
See also pic. 4 (p. 7)

## Correction factors:

Condition of pavement:	Good	Average	Poor
Motorway, Semi-Mw, Main I/II, Regional	0,99	1,00	1,03
Local/oil gravel	0,99	1,00	1,03
Local/gravel	0,99	1,00	1,03

## Change p/km:

Hilliness:	0 m/km	Average	35 m/km
Motorway, Semi-Mw	-	-	+4
Main I/II, Regional	-3	-	+10
Local	-5	-	+11

Traffic volume (ADT):	-100%	Average	+200%	+300%
Motorway	-	-	-	-
Semi-Mw	-	-	-	-
Main I/II	-3	-	+2	+5
Regional	-5	-	+5	+8
Local	-5	-	+5	+9



## TIME COSTS - Passenger cars and trucks

Table 3: Time costs of passenger car (p/km)

Passenger car	Speed km/h							
Road	50	60	70	80	90	100	110	120
Motorway	57	48	41	36	32	29	26	24
Semi-mw	57	48	41	36	32	29	26	24
Main I/II	57	48	41	36	32	29	26	
Regional	57	48	41	36	32	29		
Local/oil gr.	57	48	41	36	32	29		
Local/gravel	57	48	41	36	32	29		

Table 4: Time costs of trucks (p/km)

Truck	Speed km/h							
Road	50	60	70	80	90	100	110	120
Motorway	160	133	114	100	89	80		
Semi-mw	160	133	114	100	89	80		
Main I/II	160	133	114	100	89	80		
Regional	160	133	114	100	89	80		
Local/oil gr.	160	133	114	100	89	80		
Local/gravel	160	133	114	100	89	80		

## ACCIDENT COSTS - Passenger cars and trucks

Table 5: Accident costs of passenger cars (p/km)<sup>1</sup>

Passenger car	Speed km/h							
Road	50	60	70	80	90	100	110	120
Motorway	-	-	4	4	4	4	4	4
Semi-mw	-	-	5	5	5	5	5	5
Main I/II	15	11	10	9	8	7		
Regional	13	10	10	9	8	7		
Local/oil gr.	12	9	9	8	9			
Local/gravel	12	9	9	8	9			

Table 6: Accident costs of trucks (p/km)<sup>1</sup>

Truck	Speed km/h							
Road	50	60	70	80	90	100	110	120
Motorway	-	-	10	10	10	10		
Semi-mw	-	15	10	10	15	15		
Main I/II	45	30	25	25	25			
Regional	40	25	25	25				
Local/oil gr.	35	20	20	20				
Local/gravel	35	20	20	20				

<sup>1</sup> These values can not be used when the effects of speed limits are evaluated. When the speed limit is raised 20 km/h, increases the rate of accidents 50 % and when the limit is lowered, decreases the rate of accidents 40%.

## ACCIDENT RATE - Cars in average

Table 7: Average accident rate, cars together, all accidents  
(number of accidents/100 mill. autokm)<sup>1</sup>

All cars	Speed km/h							
Road	50	60	70	80	90	100	110	120
Motorway	-	-	-	35	35	35	30	35
Semi-Mw	-	-	-	50	45	40	40	
Main I/II	250	120	70	60	55	50		
Regional	150	100	70	60	55	50		
Local/oil gr.	140	80	70	70	70			
Local/gravel	140	80	70	70	70			

Table 8: Average accident rate, cars together, accidents with personal injuries or fatalities  
(number of accidents/100 mill. autokm)<sup>1</sup>

All cars	Speed km/h							
Road	50	60	70	80	90	100	110	120
Motorway	-	-	-	10	10	10	10	10
Semi-mw	-	-	-	15	15	13	13	
Main I/II	70	35	25	20	16	13		
Regional	60	30	25	20	16	13		
Local/oil gr.	50	30	25	20	20			
Local/gravel	50	30	25	20	20			

<sup>1</sup> These values can not be used when the effects of speed limits are evaluated. When the speed limit is raised 20 km/h, increases the rate of accidents 50 % and when the limit is lowered, decreases the rate of accidents 40%.

## ROAD USER COSTS - Urban area conditions

Table 9: Vehicle costs (p/km)

Speed (km/h)	Passenger car	Truck
20	122	384
30	113	357
40	108	342
50	104	326
60	100	321

Table 10: Time costs (p/km)

Speed (km/h)	Passenger car	Truck
20	144	399
30	96	266
40	72	200
50	57	160
60	48	133

Table 11: Accident costs (p/km, actual speed before accident)

Speed (km/h)	Passenger car	Truck
20	8	20
30	10	25
40	12	30
50	15	40
60	17	45

Table 12: Accident rate (number of accidents/100 mill. autokm)

Speed (km/h)	Passenger car	Truck
20	50	20
30	60	25
40	75	30
50	90	40
60	110	50



**Table 13: Correction factors for different road conditions: vehicle costs  
(same figures apply to passenger cars and trucks)**

Road	Summer conditions <sup>1</sup>	Winter fact. <sup>2</sup>		Winter conditions <sup>3</sup>			
		AC <sup>4</sup>	OG	AC	OG		
<b>Motorway Semi-Mw Main I/II</b>	Good	0,99				Thin snow (<5cm)	1,05
	Average <sup>5</sup>	1,00		1,03		Thick snow(5-10cm)	1,10
	Poor	1,03				Packed snow	1,05
						Slush (5cm)	1,10
						Icy road	1,05
<b>Regional roads</b>	Good	0,99	1,00			Thin snow (<5cm)	1,05
	Average <sup>5</sup>	1,00	1,02	1,03	1,05	Thick snow (5-10cm)	1,12
	Poor	1,03	1,05			Packed snow	1,08
						Slush (5cm)	1,10
						Icy road	1,08
		OG	GR	OG	GR		
<b>Local roads</b>	Good	0,99	1,00			Thin snow (<5cm)	1,05
	Average <sup>5</sup>	1,00	1,01	1,05	1,08	Thick snow (5-10cm)	1,12
	Poor	1,03	1,05			Packed snow	1,10
						Icy road	1,10

**Other conditions: Frost damage period**

<b>Regional roads</b>	Light	1,10/1,15	<b>Local roads</b>	Light	1,15/1,15
	Severe	1,15/-		Severe	1,20/-

**Table 14: Correction factors for different road conditions: accident costs**

Road	Summer conditions	Winter conditions (passenger car = truck)	
<b>All</b>	Little effect	Slush (5cm)	10
		Icy road	30
			10
		Southern Finland	
		Rest of country	

1 The condition of the pavement

2 Extra costs due to the winter (uncovered, dry surface of the road)

3 Notice the speed effect: the average speed of cars reduces

4 AC = asphalt concrete, OG = oil gravel, GR = gravel

5 The cost values in this report are for average conditions

## FUNCTION TRANSFORMATIONS OF COST TABLES

Function approximations of base costs:

$$y = \text{cost p/km} \quad x = \text{speed km/h}$$

## Vehicle costs/passenger car:

Motorway	$y = 105,46 - 0,33x + 0,0030x^2$
Semi-Mw	$y = 105,96 - 0,33x + 0,0030x^2$
Main I/II	$y = 120,71 - 0,65x + 0,0050x^2$
Regional	$y = 122,57 - 0,61x + 0,0048x^2$
Local/oil gr.	$y = 125,14 - 0,53x + 0,0041x^2$
Local/gravel	$y = 137,14 - 0,82x + 0,0061x^2$

## Vehicle costs/trucks

Motorway	$y = 408,67 - 2,97x + 0,021x^2$
Semi-Mw	$y = 410,67 - 2,97x + 0,021x^2$
Main I/II	$y = 411,00 - 2,80x + 0,020x^2$
Regional	$y = 421,65 - 3,04x + 0,023x^2$
Local/oil gr.	$y = 446,65 - 3,59x + 0,027x^2$
Local/gravel	$y = 453,30 - 3,37x + 0,025x^2$

Time costs  $a = 28,75$   $b = 79,90$

Passenger car	$y = 100a/x$
Truck	$y = 100b/x$

## Accident costs/passenger car

Motorway	$y = 4,0$
Semi-Mw	$y = 5,0$
Main I/II	$y = 35,00 - 0,54x + 0,0027x^2$
Regional	$y = 23,14 - 0,27x + 0,0011x^2$
Local roads	$y = 37,80 - 0,77x + 0,0050x^2$

## Accident costs/trucks

Motorway	$y = 10,0$
Semi-Mw	$y = 75,43 - 1,66x + 0,011x^2$
Main I/II	$y = 179,00 - 3,95x + 0,025x^2$
Regional	$y = 211,75 - 5,33x + 0,038x^2$
Local roads	$y = 206,75 - 5,33x + 0,038x^2$

### 3 PRINCIPLES OF DETERMINING UNIT COST VALUES

#### 3.1 Vehicle costs

The user costs have been evaluated from vehicle owner's point of view. So the values have been taken as prime cost prices including indirect taxes on the price of fuel, spare parts and vehicles.

The rate of interest in investments into busses and trucks has been valued according to profit demand of 10%. Respectively the calculating rate for passenger cars is 8,5% and for vans 9,5%.

The depreciation periods of average vehicles used in calculations correspond to the average expected life cycle of each vehicle type.

* Passenger car	p. 21
* Van	p. 23
* Bus	p. 24
* Truck	p. 25

**Passenger car**

The default data for estimation of vehicle cost are:

- Fuel consumption	8,2 l/100 km	
- Average annual kilometrage	17 500 km <sup>1</sup>	
- Purchase price	83 000 FIM	
- Depreciation time	12,5 years	
- Price deduction	15 %/a	
- Rate of interest	8,5 %/a	
- Fuel prices <sup>2</sup>	3,31 FIM/l	(99-oct, 45%)
	3,12 FIM/l	(92-oct, 40%)
	2,34 FIM/l	(diesel, 15%)
	3,09 FIM/l	(average)

**Table 15: Annual average vehicle cost of passenger car (p/km)**

Cost factor	p/km	
Fuel	25,3	Variable part 45,5 p/km
Repair, service and lubrication	16,9	
Tyre-wear	3,3	
Motor vehicle tax, maintenance	6,9	Fixed part 61,7 p/km
Capital depreciation	33,0	
Capital interest	21,8	
<b>Total</b>	<b>107,2</b>	

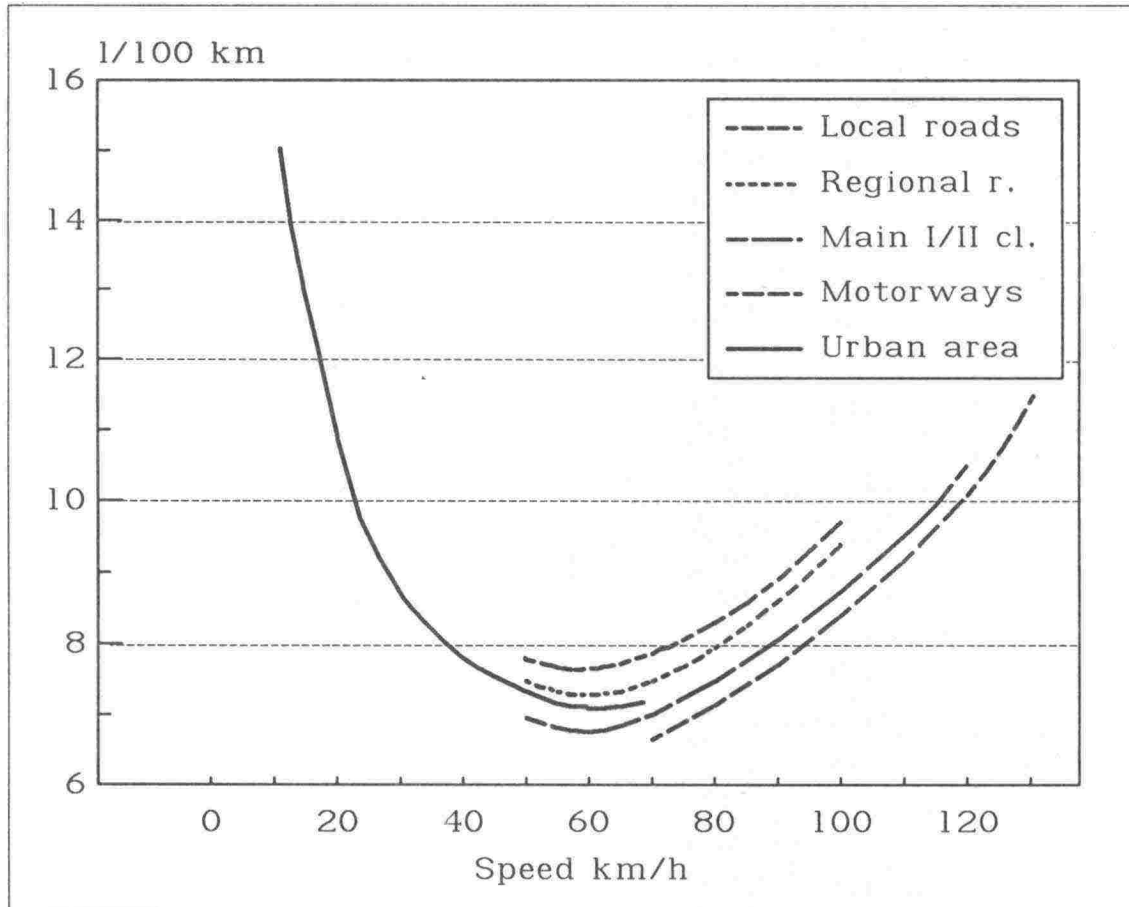
Insurance fee (10,7 p/km) is not included in vehicle costs, because accident costs have been defined separately.

<sup>1</sup> Proportion of diesel-driven cars of the passenger car fleet is 7,7% and respectively 15% of the traffic performance of passenger cars.

<sup>2</sup> Average prices in gas-stations in Finland 9.1.1988

The dependency between fuel consumption and speed on different road classes for an average passenger car is presented in figure 7. The consumption curves are estimated for each road class on their average traffic conditions (free-flowing traffic).

**Fig. 7: Average fuel consumption of passenger car in various speeds and road classes (steady traffic flow)**



With the curves the fuel consumption of the passenger car can be estimated when it moves on a certain type of road in free-flowing traffic at fairly steady speed. Whereas they can not be directly used when comparing various road and speed alternatives: if the road and traffic conditions (local speed limits, gradients, junctions, congestion etc.) cause local and/or occasional slowdown of speed, increases the fuel consumption clearly and that is not taken into account in estimating these curves.



## Van

The default data for estimation of vehicle cost are:

- Fuel consumption	11 l/100 km	
- Average annual kilometrage	16 500 km	
- Purchase price	75 000 FIM	
- Depreciation time	10 years	
- Price deduction	20 %/a	
- Rate of interest	9,5 %/a	
- Fuel prices <sup>1</sup>	3,12 FIM/l	(92-oct.)
	2,34 FIM/l	(diesel)
	2,57 FIM/l	(average)

- About 30% of the kilometrage of the vans is estimated to be driven using gas

Table 16: Annual average vehicle cost of a van (p/km)

Cost factor	p/km	
Fuel	28,3	Variable part 50,5 p/km
Repair, service and lubrication	17,0	
Tyre-wear	5,2	
Maintenance	7,4	Fixed part 72,0 p/km
Capital depreciation	40,6	
Capital interest	24,0	
Total	122,5	

Insurance fee (10,5 p/km) is not included into vehicle costs, because accident costs have been defined separately.

<sup>1</sup> Average prices in gas-stations in Finland 9.1.1988

**Bus**

The default data for estimation of vehicle costs are:

- Fuel consumption	30,5 l/100 km
- Average annual kilometrage	70 000 km
- Purchase price	750 000 FIM
- Depreciation time	12 years
- Price reduction	20 %/a
- Rate of interest	10 %/a
- Fuel prices <sup>1</sup>	2,34 FIM/l (diesel)

**Table 17: Annual average vehicle cost of a bus (p/km)**

Cost factor	p/km	
Fuel	71,4 <sup>2</sup>	Variable part 151,4 p/km
Lubrication	10,9	
Repair, service	58,6	
Tyre-wear	10,5	
Maintenance, overhead costs	22,0	Fixed part 168,5 p/km
Capital depreciation	83,2	
Capital interest	63,3	
<b>Total</b>	<b>319,9</b>	

Insurance fee (13,9 p/km) is not included into vehicle costs, because accident costs have been defined separately.

<sup>1</sup> Average gas-station prices in Finland 9.1.1988, the actual price is 1,61 FIM/l, because regular bus service do not pay fuel taxes.

<sup>2</sup> After the tax refund is fuel cost 49,1 p/km and variable costs together 129,1 p/km and vehicle costs total 297,6 p/km.



## Trucks

The vehicle costs have been separately estimated for a truck, tractor with semi-trailer and trailer. The average figure for truck's vehicle cost has been calculated by weighting according to the traffic performance of different types of trucks.

The default data for estimation are:

		Truck	T with semi-tr.	T with trailer
- Fuel consumption	(l/100 km)	26	37	43
- Annual kilometrage	(km)	34 000	75 000	94 000
- Purchase price	(FIM)	311 000	685 000	811 000
- Depreciation time	(a)	10	10	10
- Price deduction	(%/a)	20	20	20
- Rate of interest	(%/a)	10	10	10
- Price of diesel oil: 2,34 mk/l <sup>1</sup>				

Table 18: Average annual vehicle costs of truck (p/km)

Cost factor	T1 <sup>2</sup> 0,50	T2 0,08	T3 0,42	T <sub>AV</sub> <sup>3</sup> 1,00	
Fuel	60,8	86,6	100,6	79,6	Variable part 171,8 p/km
Lubrication	11,0	15,6	18,1	14,4	
Service, repair	46,4	46,1	43,8	45,3	
Tyre-wear	21,9	37,4	44,3	32,5	
Motor vehicle tax, maintenance, administr. exp.	45,8	46,5	43,9	44,9	Fixed part 174,6 p/km
Capital depreciation	81,6	81,5	77,0	79,7	
Capital interest	51,2	51,2	48,3	50,0	
Total	318,7	364,9	376,0	346,4	

Insurance fee is not included into vehicle costs, because accident costs have been defined separately. The amount of the fee would be: T1 19,7, T2 16,7 and T3 15,2 p/km and the weighted average 17,2 p/km.

<sup>1</sup> Average gas-station price 9.1.1988

<sup>2</sup> T1= truck w/o trailer, T2= tractor with semi-trailer, T3= tractor with trailer

<sup>3</sup> Weighting according to the share of the total traffic performance

### 3.2 Time costs

The value of time is quite a common topic in the international literature of transport economics. There is no generally accepted solution to the problem. So it has to be admitted that finally the value of time must be based on an agreement. Or then the time factor must be dealt with time units only (e.g. by hours).

The values of time in this publication are based to the recommendations of a task group by Ministry of Communications (known as YHTALI-task group). However, here for the value of time has been taken a somewhat wider meaning than the original recommendation defined.

The time saved has not been thought to have direct value for alternative use, but 'the time saving' is considered to show the consequences of a road project to the accessibility and driving comfort (as far as it is connected to the shortened time of a trip).

\* *Passenger car*                      *p. 27*

\* *Other cars*                         *p. 28*

### Passenger car (driver and passengers)

The value of time is connected with the average hourly wage of an industrial worker (male)<sup>1</sup>. The value of time varies according to the purpose of trip :

- work trips: the value of time is the gross hourly wage plus social security costs
- business trips (work/personal): 35% of the average hourly gross wage
- leisure and holiday trips: 20% of the average hourly wage.

In table 19 are presented the time values for a passenger car. If the purpose of trip is not known, the combined value is to be used (time costs per kilometre is based on the combined value). On the evaluation of road projects the combined value is usually used.

**Table 19: Time values for passenger car (FIM/h)**

Purpose of trip	Av. number of persons /vehicle	FIM/hour	
		/person	/vehicle <sup>2</sup>
Work	1,1	64,40	70,80
Business trip (work/person)	1,5	14,40	21,50
Leisure and holiday	2,3	8,20	18,90
Combined value <sup>3</sup>	1,784	(16,10)	28,75

<sup>1</sup> 41,00 FIM, estimated 1/88

<sup>2</sup> Value of time for the average number of persons in car (incl. driver).

<sup>3</sup> Combined value weighted according to estimated division of vehicle kilometers: 17, 39 and 44 (work/business/leisure).

**Van, bus and truck**

In table 20 there are unit costs of time for various vehicles in commercial use. The calculations of the price of an hour are based on the average wage of driving personnel plus social costs. The time value of passengers in busses is according to the combined value in table 19.

**Table 20: Time values for commercial road traffic (FIM/h)**

Vehicle	Av. number of persons /vehicle	FIM/hour	
		/person <sup>1</sup>	/vehicle <sup>2</sup>
Van	1,0	57,90	57,90
Truck	1,1	72,60	79,90
Bus	1+13,5 <sup>3</sup>	(30,75)	445,70

<sup>1</sup> Based on estimated wages on 1/1988

<sup>2</sup> Time value for persons in cars only

<sup>3</sup> On public roads

In commercial transport the freight has not here own time value. The time value of transportations is a problem which is still without acceptable solution.

### 3.3 Accident costs

Internationally there are no generally accepted rules to calculate costs of road traffic accidents. Principles of calculations vary greatly from country to country. The main problem is how to evaluate the human losses.

In Finland the accident cost calculations are based on *the method of the social willingness to pay*. Same kind of evaluation methods are in use in Sweden and Denmark. In these countries the level of traffic safety (measured by fatalities/100 000 persons) is about the same as in Finland.

*The social readiness to pay*-method tries to include the total loss of well-being in the society: the real economic costs and human sufferings. The society is willing by investments in traffic safety to minimize the costs of traffic accidents and also to diminish the probability of accidents and by this way to increase the non-material well-being in society.

Thus the accident costs are evaluated higher than the real monetary costs alone would be.

According to the above mentioned method accident costs include:

1. *Monetary values of*
  - lost work (wage + soc. costs)
  - hospital care
  - administrative expenses (police etc.)
  - (funeral)
  - damages to vehicles
  - damages to road constructions
  
2. *Loss in human values*
  - This includes the human losses due to the accident and the diminished well-being due to the probability of a road accident.

Monetary evaluation of loss in human values is very difficult or impossible, so finally there must be an agreement of the proper value and method.

In this report the lost human values are evaluated for three types of accidents:

- *Fatality*: The value is the cost of hospital care of a fully handicapped victim under the average expected lifetime.
  
- *Permanently injured*: The value of the lost well-being is based on the average rate of handicap and is 20% of the value of a fully handicapped person.
  
- *Temporarily injured*: The value has to be evaluated by comparing the number of days in hospital and inability to work with the consequent days of the permanently injured. The value of the loss is about 2,5% of the loss of the permanently injured.

**Table 21: Unit cost values of traffic accidents in public roads**

Type of accident	Unit cost value (FIM)		
	Economic loss	Loss in human values	Total
Fatality	1 400 000	1 850 000	3 250 000
Permanently injured	750 000	400 000	1 150 000
Temporarily injured	26 500	9 000	35 000
Injured in average	69 000	21 000	90 000
Material damages per personal damage	8 000	0	8 000

**Table 22: Average costs of accidents in public roads**

Accident type	Cost (FIM)
Fatal	3 700 000
Injurious	140 000
Injury accident in average	575 000
Material damages	20 000
Road accident in average	190 000

The costs are evaluated to the price level of the January 1988 and they are based on RWA's accident statistics<sup>1</sup>.

<sup>1</sup> A great deal of minor accidents with material damages escapes the statistics. The number of accidents with personal damages in statistics is on the contrary quite realistic. So the evaluated average price of personal accident is more reliable than the price of a road accident in average which is probably too big.



### Cost per kilometre: notes on principles

The accident costs per vehicle kilometre are based on the accident rates of various classes of roads. The speed here is thought to be according to the speed limit, except in urban area conditions, where the speed is the real speed of a vehicle. The costs are divided to passenger cars and trucks according to their share in accidents<sup>1</sup>.

Accident costs per vehicle kilometre are the average costs of a certain road class in summer conditions. The traffical properties of a road class will be reflected by the speed limit.

The decreasing of accident costs when the speed increases is due to the better characteristics of a road, e.g. the geometry of the road. Great accident costs of low speeds (50 and 60 km/h) on I and II class main roads are partly result of different division of traffic modes in urban areas: the number of accidents of light traffic is greater and so is also the junction density.

It has to be noticed that on the same road the higher speed increases the accident costs and makes the rate of accidents also higher.

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<sup>1</sup> In this year report the costs is divided to trucks according to their share in accidents with fatalities. This is why the accident costs of trucks have been increased considerably from the previous year.



